

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE (9–1)**

J250/04

**COMBINED SCIENCE
(CHEMISTRY) A (GATEWAY SCIENCE)
Paper 4, C4–C6 and CS7 (PAGs C1–C5)
(Foundation Tier)**

WEDNESDAY 13 JUNE 2018: Morning

**TIME ALLOWED: 1 hour 10 minutes
plus your additional time allowance**

MODIFIED ENLARGED 36pt

| | | | |
|-----------------------|--|----------------------|--|
| First name | | Last name | |
|-----------------------|--|----------------------|--|

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|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|
| Centre number | | | | | | Candidate number | | | | |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|

YOU MUST HAVE:

a ruler (cm/mm)

the Data Sheet (for Chemistry A)

YOU MAY USE:

a scientific or graphical calculator

an HB pencil

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS

The Data Sheet will be found with this document.

Use black ink. You may use an HB pencil for graphs and diagrams.

Complete the boxes on the front page with your name, centre number and candidate number.

Answer ALL the questions.

Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION

The total mark for this paper is 60.

The marks for each question are shown in brackets [].

Quality of extended responses will be assessed in questions marked with an asterisk (*).

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SECTION A

Answer ALL questions.

You should spend a maximum of 20 minutes plus your additional time allowance on this section.

- 1 Large scale desalination is used to make drinking water from seawater in hot countries.**

What is the name of the technique used to remove the dissolved salts from seawater to get drinking water? [1]

- A Chromatography**
- B Evaporation**
- C Filtration**
- D Simple distillation**

Your answer

2 Which statement about catalysts is correct? [1]

- A A catalyst decreases the rate of many different reactions.**
- B A catalyst for one reaction will be the catalyst for many different reactions.**
- C A catalyst has no effect on the rate of the reaction.**
- D A catalyst usually increases the rate of a reaction.**

Your answer ☐

3 Look at the table.

| | State at room temperature | Electronic structure |
|---|---------------------------|----------------------|
| A | Gas | 2.7 |
| B | Gas | 2.8.7 |
| C | Liquid | 2.8.7 |
| D | Solid | 2.7 |

Which row in the table has the correct information about chlorine? [1]

Your answer

4 Iron can be extracted from its ore by heating it with carbon.

Which statement is the correct explanation for this? [1]

A Iron is above carbon in the reactivity series.

B Iron is above copper in the reactivity series.

C Iron is below carbon in the reactivity series.

D Iron is below sodium in the reactivity series.

Your answer

5 Look at the table.

| | Nitrogen | Oxygen | Carbon dioxide |
|---|----------|--------|----------------|
| A | 21% | 78% | 0.04% |
| B | 80% | 15% | 5% |
| C | 70% | 20% | 10% |
| D | 78% | 21% | 0.04% |

Which row in the table shows the correct percentages of gases in the present day atmosphere? [1]

Your answer

- 6 Look at the equation for the reaction between nitrogen and hydrogen to make ammonia.**



The reaction forms a DYNAMIC EQUILIBRIUM.

Which of the following describes dynamic equilibrium? [1]

- A All the reactants and products are gases.**
- B The rate of the backward reaction is greater than the rate of the forward reaction.**
- C The rate of the forward and backward reactions are equal.**
- D The rate of the forward reaction is greater than the rate of the backward reaction.**

Your answer ☐

7 The Group 0 elements are unreactive.

Why are they unreactive? [1]

A They all exist as single atoms.

B They are all gases.

C They have a full outer electron shell.

D They need one electron to gain a full outer electron shell.

Your answer ☐

8 Look at the boiling points of some Group 7 elements.

| Element | Boiling point in °C |
|-----------------|----------------------------|
| Fluorine | −188 |
| Chlorine | −34 |
| Bromine | 59 |

What is the most likely boiling point of iodine? [1]

A −20 °C

B 50 °C

C 184 °C

D 350 °C

Your answer

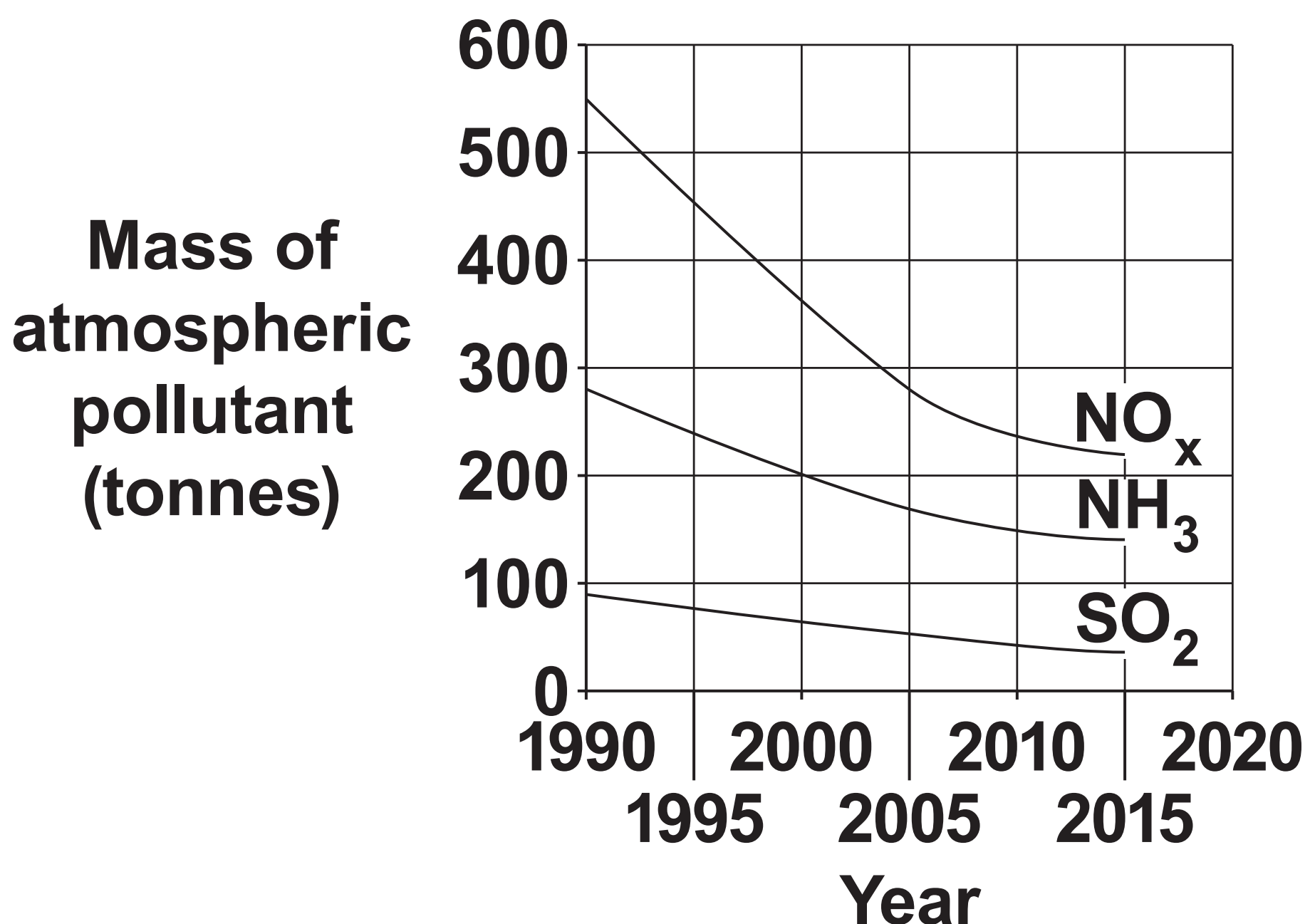
9 The graph shows how the masses of three atmospheric pollutants have changed in one city since 1990.

The atmospheric pollutants are:

Oxides of nitrogen, NO_x

Ammonia, NH_3

Sulfur dioxide, SO_2



**In which year was 280 tonnes of
OXIDES OF NITROGEN present in the
atmosphere? [1]**

A 1990

B 2000

C 2005

D 2010

Your answer

10 Look at the graph for question 9, shown again opposite.

Which statement is true based on the data on the graph? [1]

- A In 2015 the level of oxides of nitrogen was higher than the levels of sulfur dioxide or ammonia.**
- B The levels of all three pollutants fell by the same amount between 1990 and 2015.**
- C The level of ammonia fell the most between 1990 and 2015.**
- D The level of sulfur dioxide decreased by more than half between 2000 and 2015.**

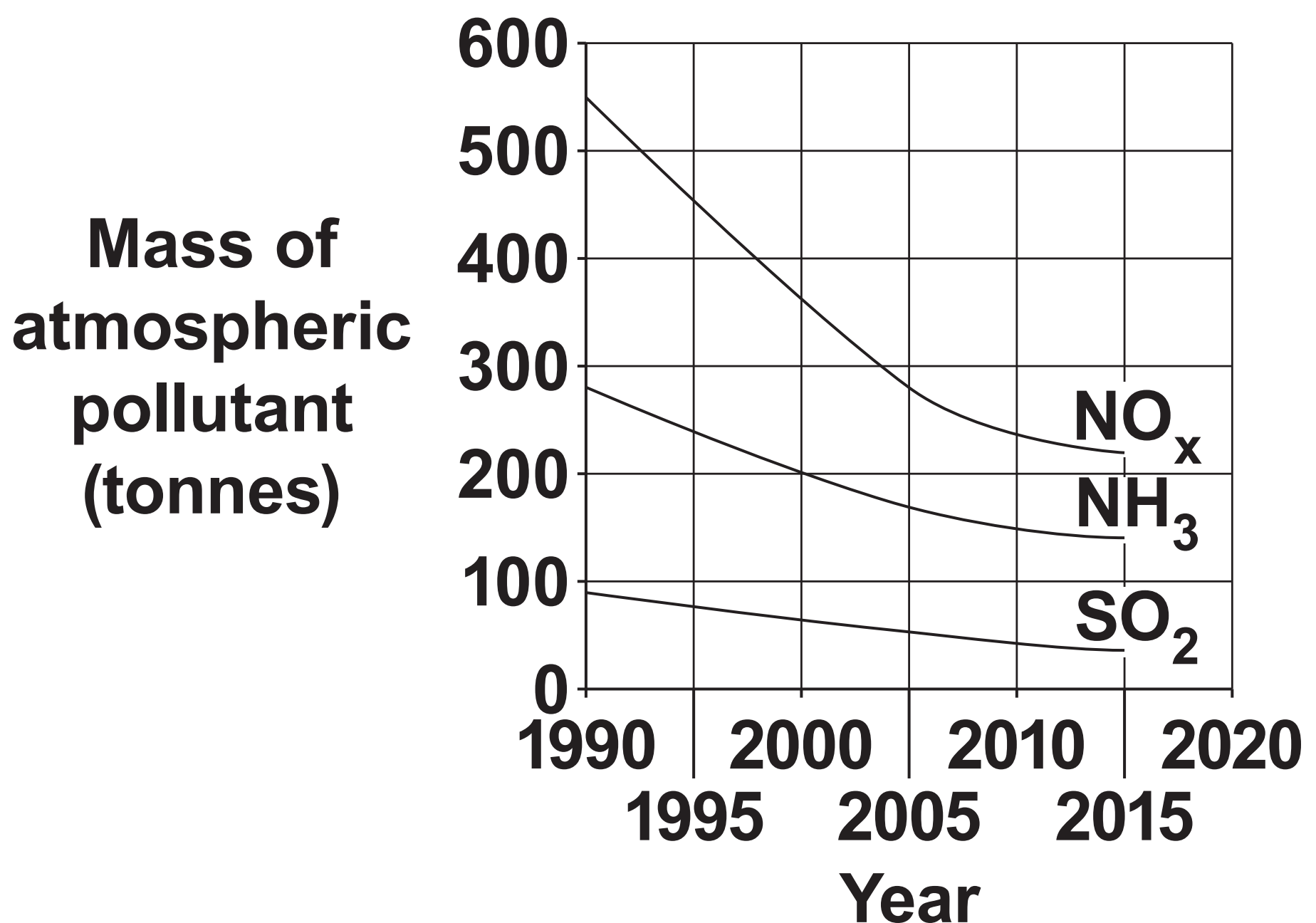
Your answer

The atmospheric pollutants are:

Oxides of nitrogen, NO_x

Ammonia, NH_3

Sulfur dioxide, SO_2



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SECTION B

Answer ALL questions.

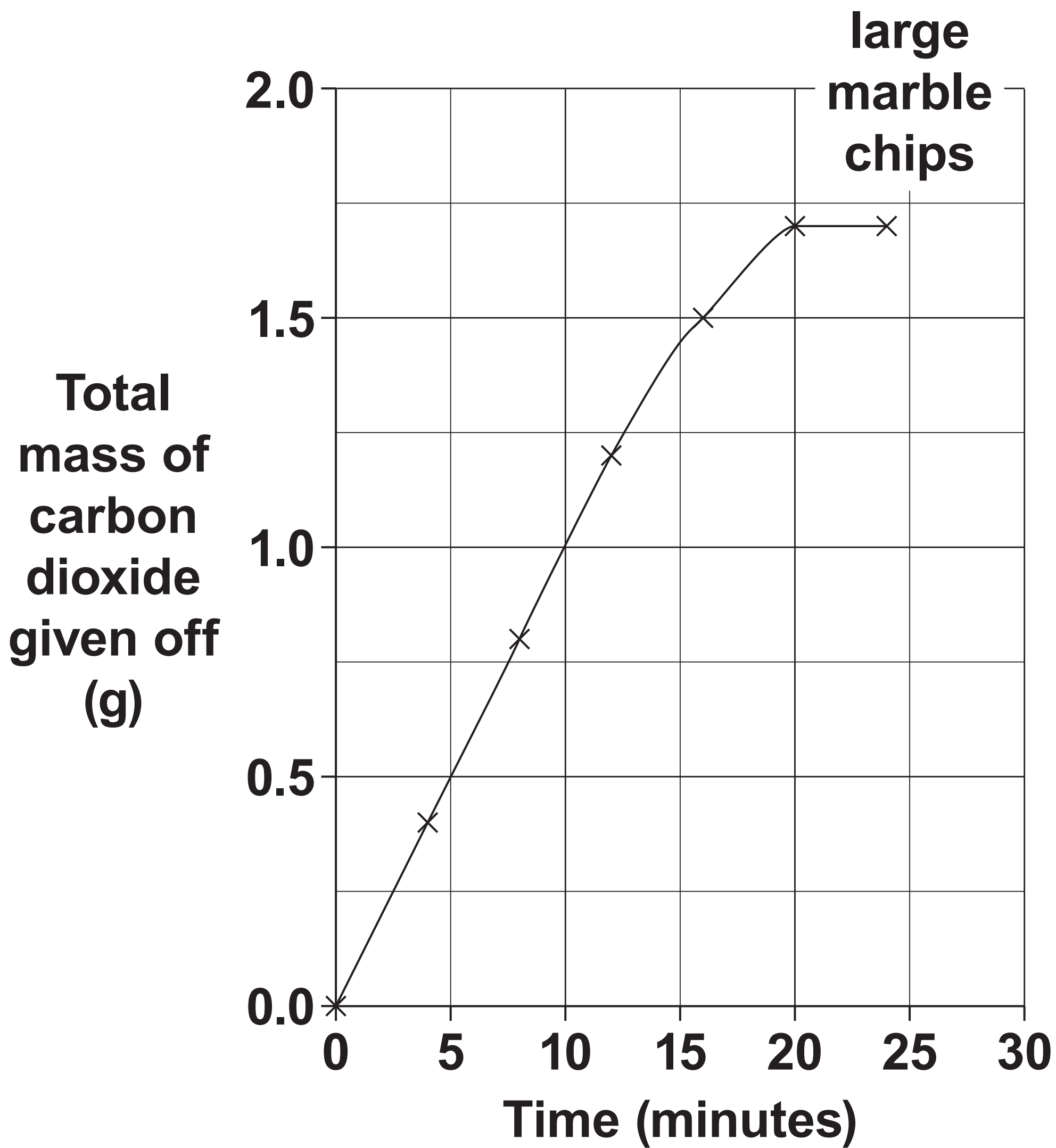
11 A student investigates the rate of reaction between marble chips and hydrochloric acid.

Both experiments use 50 cm³ of hydrochloric acid and an excess of marble chips.

He measures the total mass of carbon dioxide given off for different sizes of marble chips.

Look at his results.

| Time (minutes) | Total mass of carbon dioxide given off (g) | |
|-------------------|--|-----------------------|
| | Large marble chips | Small marble chips |
| 0 | 0.0 | 0.0 |
| 4 | 0.4 | 0.8 |
| 8 | 0.8 | 1.4 |
| 12 | 1.2 | 1.6 |
| 16 | 1.5 | 1.7 |
| 20 | 1.7 | 1.7 |
| 24 | 1.7 | 1.7 |



(a) The student has plotted his results for the large marble chips on the graph.

(i) Plot the results for the SMALL marble chips. [2]

(ii) Draw a line of best fit. [1]

(b) Look at the line for the LARGE marble chips.

(i) How long does it take for the reaction to finish?

Answer = _____ minutes [1]

(ii) What mass of carbon dioxide is given off after 15 minutes?

Answer = _____ g [1]

(c) The reaction is faster with small marble chips.

Write down TWO ways that the graph shows this is correct.

1 _____

2 _____

[2]

(d) Both small and large marble chips give off the same mass of carbon dioxide at the end of the experiments.

Suggest why.

[1]

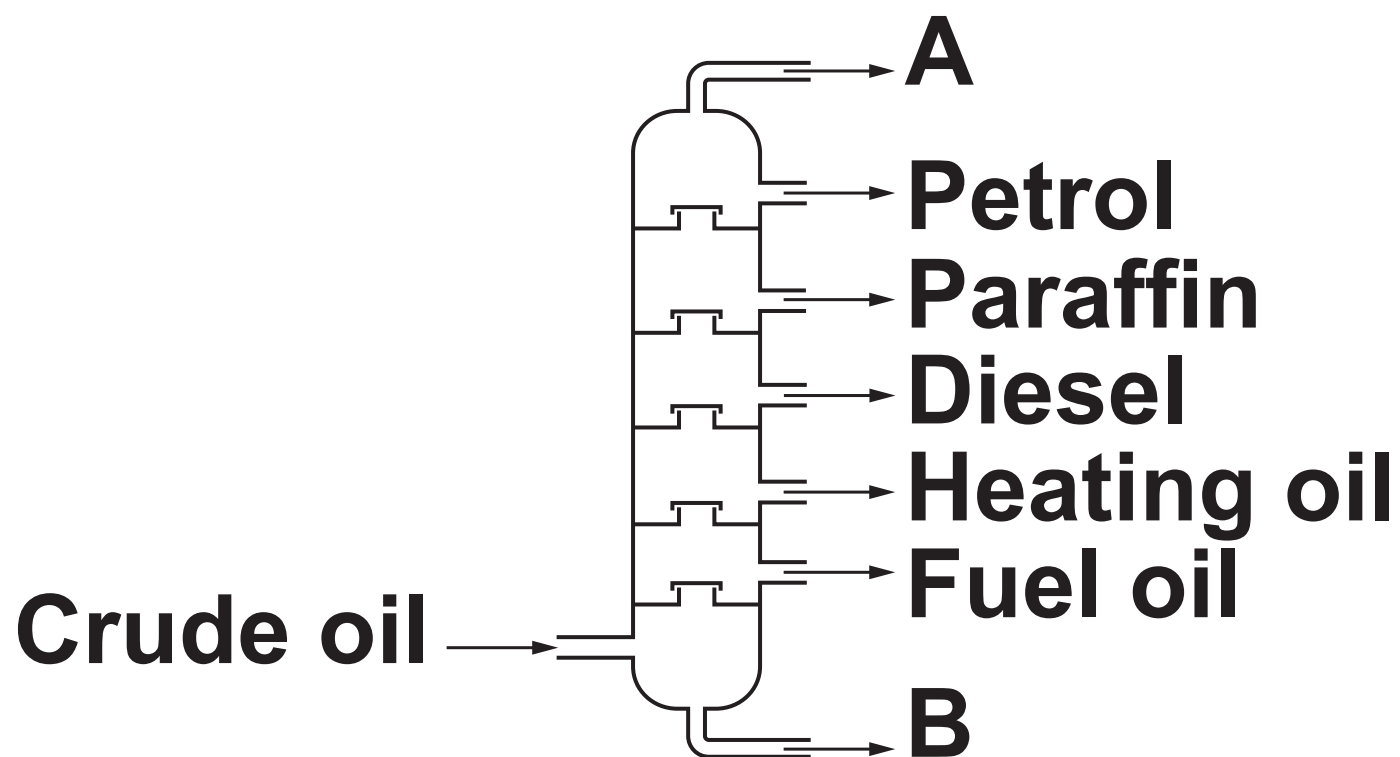
- (e) A balance was used to measure the amount of carbon dioxide given off.**

Write down the name of a different piece of equipment that could be used to measure the amount of carbon dioxide produced.

_____ **[1]**

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12 Crude oil can be separated into useful substances called fractions.



(a) Write down the name of the process that separates crude oil into fractions.

_____ [1]

(b) Name the fractions A and B. [2]

A _____

B _____

(c) Here are the boiling ranges for petrol and diesel.

| Fraction | Approximate boiling range (°C) | Number of carbons |
|-----------------|---------------------------------------|--------------------------|
| Petrol | 30–80 | 5–10 |
| Diesel | 205–290 | 13–17 |

(i) How do the sizes of molecules in petrol and diesel differ?

_____ **[1]**

(ii) Explain why the boiling range for petrol is different from the boiling range for diesel.

_____ **[3]**

(d) Not enough petrol is made from crude oil to meet world demand.

Oil refineries make more petrol using a process called CRACKING.

Describe how cracking makes more petrol from other hydrocarbons.

Include the conditions needed.

[3]

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13 Complete the sentences about how the Earth's atmosphere has evolved. [4]

Choose words from the list.

argon

condensed

melted

nitrogen

oxygen

sunlight

thunderstorms

volcanoes

The earliest atmosphere was made up of ammonia, carbon dioxide and water vapour.

These gases were released by

_____.

The water vapour _____ to form the oceans.

Ammonia was converted by bacteria in the soil to make _____.

The earliest plants photosynthesised.

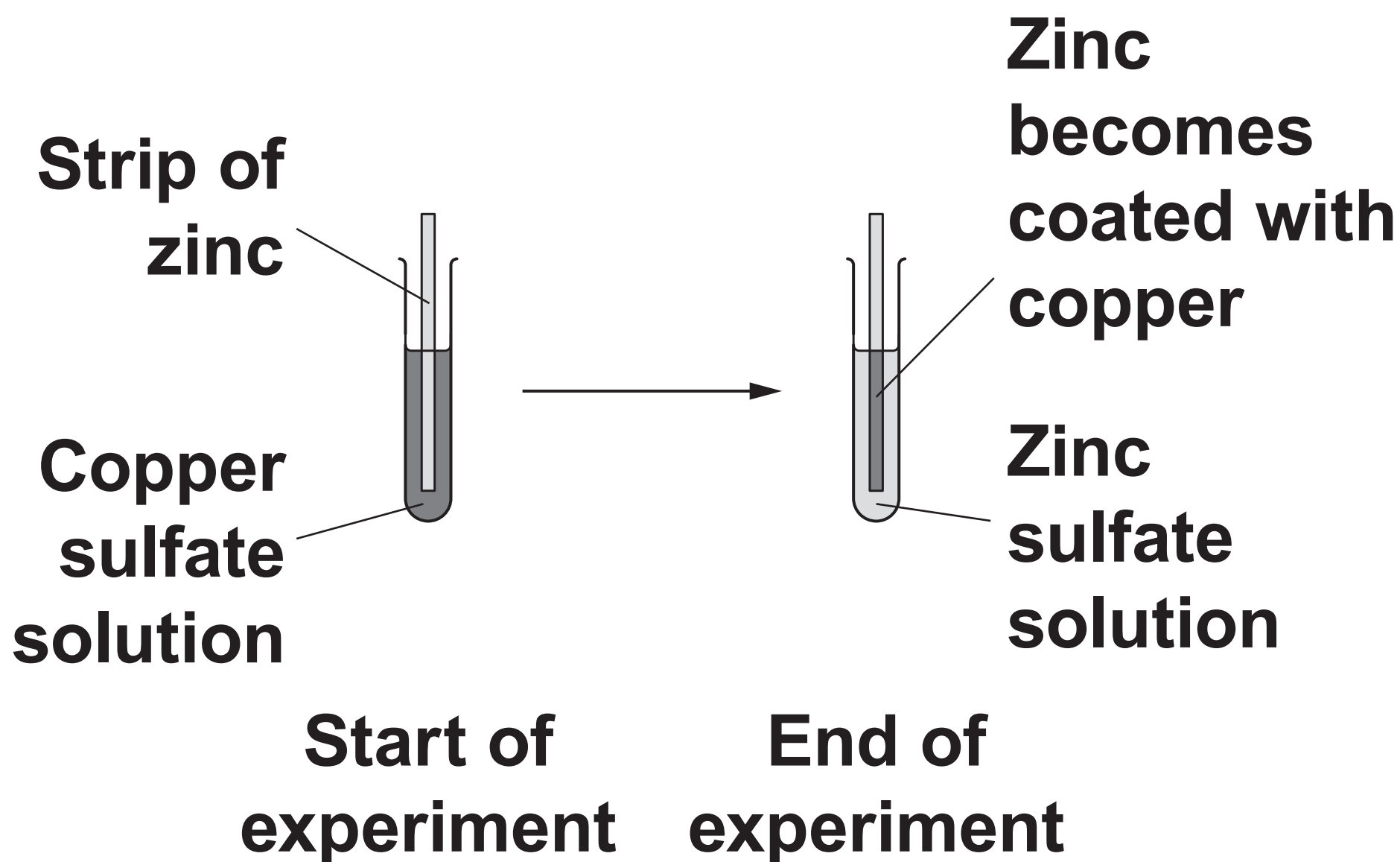
They absorbed carbon dioxide and

released _____ gas.

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14 A student investigates the reactivity of some metals with metal salts.

The diagram shows one of the experiments that he does.



He repeats the experiment using other metals and solutions.

Look at his results.

| Solution | Metal added | | | | |
|-------------------|-------------|------|-----------|--------|------|
| | Silver | Zinc | Magnesium | Copper | Iron |
| Copper sulfate | X | ✓ | ✓ | | ✓ |
| Zinc sulfate | X | | ✓ | X | X |
| Silver nitrate | | ✓ | ✓ | ✓ | ✓ |
| Magnesium sulfate | X | X | | X | X |
| Iron sulfate | X | ✓ | ✓ | X | |

✓ = Metal reacts
X = Metal does not react

(a) Use the results to place the metals in order of reactivity.

MOST reactive metal

LEAST reactive metal

Explain your reasoning.

[4]

(b) Write a WORD EQUATION for the reaction between copper and silver nitrate solution.

_____ **[1]**

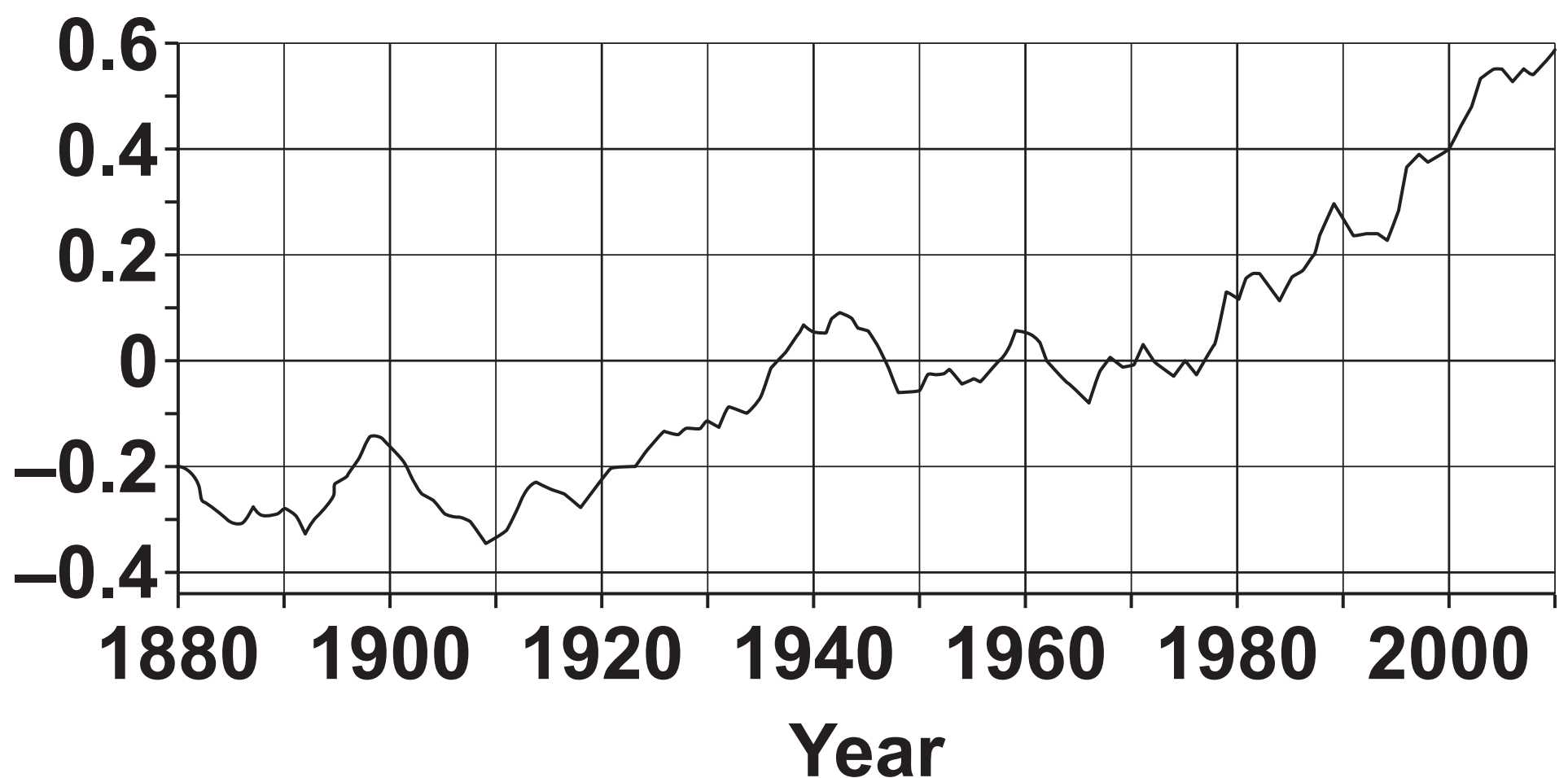
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15 Look at the graphs.

GRAPH 1 shows how the Earth's temperature has changed between 1880 and 2010.

GRAPH 1

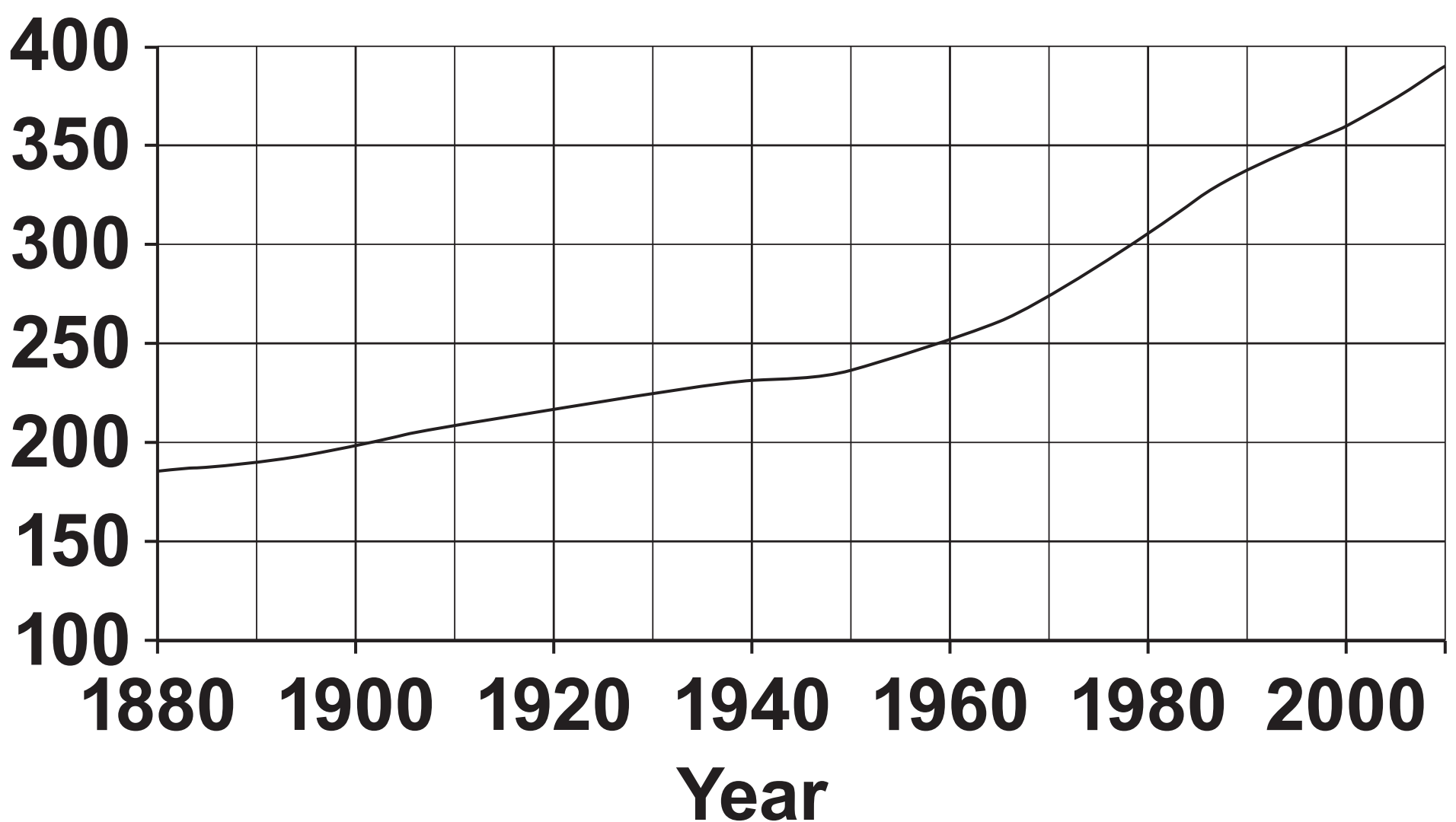
Temperature change ($^{\circ}\text{C}$)



GRAPH 2 shows how the amount of carbon dioxide in the air has changed between 1880 and 2010.

GRAPH 2

**Carbon dioxide
(parts per million)**



(a) In GRAPH 1, how much has the Earth's temperature increased between 1880 and 2000?

Answer = _____ °C [1]

(b) In GRAPH 2, what is the difference between the amount of carbon dioxide in the air between 1880 and 2000?

Answer = _____ parts per million [1]

(c) Some scientists believe that GRAPH 1 and GRAPH 2 show that increased levels of carbon dioxide have increased the Earth's temperature.

Other scientists believe that it is just a natural cycle of change.

Quote data from the graphs which support BOTH of these arguments.

Evidence to support increased temperature of Earth

Evidence to support a natural cycle

[2]

16* Look at the information about three elements X, Y and Z in the Periodic Table.

| Element | X | Y | Z |
|---|---|--|---|
| Atomic number | Less than 11 | 11 | More than 11 |
| Melting point (°C) | 181 | 98 | 64 |
| Number of electrons in outer shell | 1 | 1 | 1 |
| Density (g/cm³) | 0.53 | 0.97 | 0.89 |
| Reaction with water | Reacts quickly making hydrogen | Reacts vigorously making hydrogen | Reacts explosively making hydrogen |
| Action of heat on the carbonates of X, Y and Z | Breaks down and makes carbon dioxide | No reaction | No reaction |

| Element | X | Y | Z |
|--------------------------------|--------------|--------------|--------------|
| Formula of chloride | $\text{XC}l$ | $\text{YC}l$ | $\text{ZC}l$ |
| Melting point of chloride (°C) | 614 | 801 | 773 |

Student A thinks that elements X, Y and Z are in the same Group of the Periodic Table.

Student B thinks they are in different Groups of the Periodic Table.

Analyse and explain the information in the table that supports BOTH Student A's and Student B's conclusions.

Who do you think is correct? [6]

17 A company wants to make a glass to hold a cold drink. They are considering materials A and B.

Look at the life cycle assessments opposite for a glass made out of materials A and B.

(a) Complete the table opposite to show the totals for each column. [2]

(b) Write down the name of process W.

_____ [1]

(c) It costs more to transport glasses made from material B.

Suggest a reason why.

_____ [1]

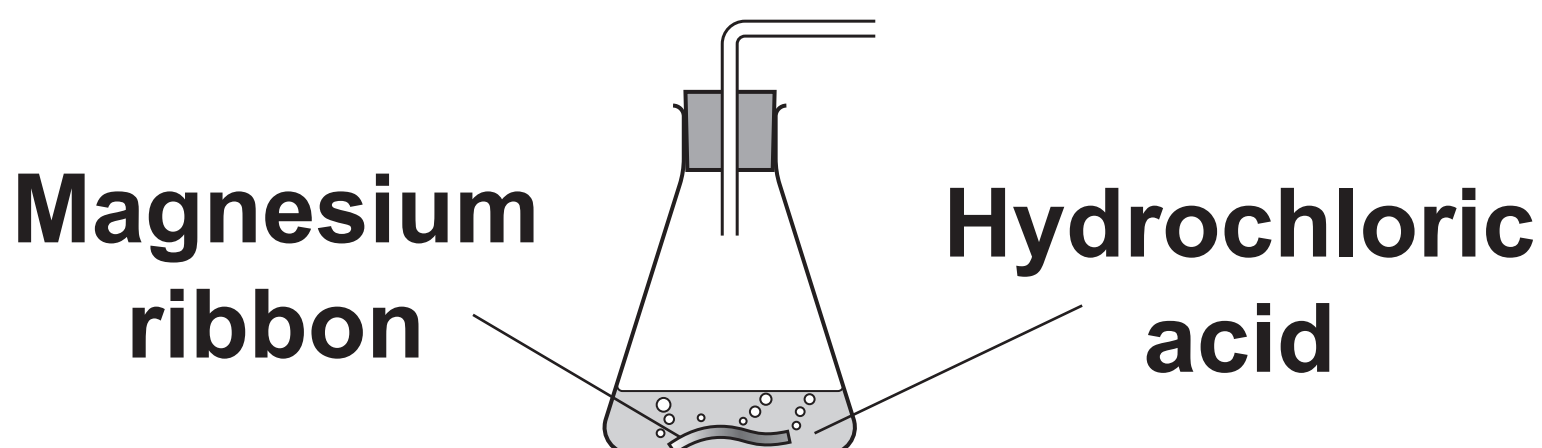
| Process | Material A | | Material B | |
|---|------------------|---|------------------|---|
| | Energy used (MJ) | Greenhouse gases made (g of CO ₂) | Energy used (MJ) | Greenhouse gases made (g of CO ₂) |
| Extracting the raw materials | 5.0 | 2.2 | 3.8 | 1.4 |
| Manufacturing of the glass from the raw materials | 0.4 | 0.3 | 0.4 | 0.1 |
| Transporting the glasses to the shops | 1.5 | 1.0 | 3.1 | 2.2 |
| Process W | 2.0 | 0.6 | 5.0 | 1.7 |
| Total | | | | |

(d) Which material should the company choose?

Justify your answer.

[2]

18 A student investigates the rate of reaction between magnesium and hydrochloric acid. The reaction gives off hydrogen gas.



The student wants to investigate how changing the CONCENTRATION of the hydrochloric acid affects the rate of reaction.

Look at her plan.

First experiment

I will put 0.5 g of magnesium ribbon into the flask.

I will add 50 cm³ of hydrochloric acid.

I will measure how fast the gas is given off.

Second experiment

I will put another 0.5 g of magnesium ribbon into the flask.

I will add 100 cm³ of the same hydrochloric acid.

I will measure how fast the gas is given off.

Another student thinks that the plan will not work and he does not understand exactly what he has to do.

Suggest how the plan for this investigation can be improved.

[4]

19 The table shows some hydrocarbons from crude oil.

| Name | Formula |
|----------------|------------------------------------|
| Methane | CH₄ |
| Propane | C₃H₈ |
| Butane | C₄H₁₀ |

(a) Nonane is another hydrocarbon from crude oil.

It contains 9 carbon atoms.

Predict the formula of nonane.

_____ **[1]**

(b) Write down the name of this homologous series of hydrocarbons.

_____ **[1]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

This image shows a blank sheet of white paper with horizontal ruling lines. A single vertical line runs down the left side, creating a narrow margin. There are ten horizontal lines spaced evenly across the page, starting from the top margin and extending to the right edge. The lines are thin and black.

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